NOAA FISHERIES
Office of Science & Technology

Ecosystem Science Program Review

Office of Science & Technology Summary and Response – October 2016

Introduction

On July 26-29, 2016, the National Marine Fisheries Service (NMFS) Office of Science & Technology (ST) hosted a panel of experts to review its Ecosystem Science Programs at the Silver Spring Civic Center. ST's Ecosystem Science Programs have been developed by NMFS to advance the incorporation of ecosystem information into living marine resource management and to implement ecosystem-based management.

The NMFS ecosystem science reviews were the fourth in a five-year cycle of annual thematic reviews designed to maximize the transparency and effectiveness of major science programs conducted at the six NMFS Science Centers and ST. The ST ecosystem review focused on the following programs: Integrated Ecosystem Assessments (IEA), Fisheries and the Environment (FATE), Marine Ecosystems and Climate, Habitat Science, Plankton Database – COPEPOD, and Ecosystem Modeling Coordination. These programs, with the exception of Habitat Science, are currently managed under ST's Marine Ecosystem Division.

The objective for this review was to evaluate the quality, relevance, and performance of overall ecosystem programs conducted by ST, centered on the following overarching questions from the Terms of Reference (click here for the complete TOR):

1. Does ST have clear goals and objectives for its ecosystem-related science programs? Are ST ecosystem programs appropriate to advance ecosystem science and management for NMFS? (appropriate topics, program structures, mechanisms and prioritization procedures)
2. Are ST ecosystem-related science programs appropriately integrated with other relevant programs? Is ST adequately collaborating with NMFS Science Centers and other relevant offices and programs across NOAA?
3. Do ST's ecosystem-related science programs provide information to address the priority needs of the Science Centers, NOAA managers, Fishery Management Councils and Commissions, and other partners for ecosystem-related information?
4. Is the suite of ST ecosystem-related science programs appropriate to address the priority needs of the Science Centers, NOAA managers, Fishery Management Councils and Commissions, and other partners for ecosystem-related information over the next 5-10 years?
5. Does ST appropriately communicate status and accomplishments of national ecosystem-based science programs to NMFS partners, stakeholders, the public, and NOAA and NMFS leadership?

ST staff provided the panel with presentations covering ST's ecosystem programs, background material for more in-depth information, and time during the review for detailed discussions with ST management and staff.

Acknowledgements

ST thanks the review panelists who devoted a significant amount of time to prepare for and participate in this review. Their insightful observations and helpful recommendations provided valuable feedback on how our ecosystem science program is performing relative to our stated goals and objectives. The panelists for this review were:

- Dr. David Fluharty (Chair) − University of Washington
- Dr. Mark Dickey-Collas − International Council for the Exploration of the Sea
- Dr. Michael Seki − Pacific Islands Fisheries Science Center
- Dr. Michael Sigler − Alaska Fisheries Science Center
- Dr. Christopher Sabine − Pacific Marine Environmental Laboratory

ST also greatly appreciates the time and thought the NMFS Science Center Directors put into their responses to the Science Center survey questions ST sent to them prior to the review. Their comments stimulated many interesting conversations and helped generate valuable recommendations for improving our programs.

Finally, we would like to express our appreciation to the ST staff for their contributions, insights, and candor during this 4-day review. Several comments in the panelists' reports highlighted the impressive work accomplished by the diligent staff. The staff's efforts contribute to advancing ecosystem science within NMFS and this informative review is a testament to their commitment and dedication.

Remarks

The overall feedback provided by the panel members was very positive, while there were also constructive comments offered for improvement that ST will address in the coming years. The Chair's summary and the reviewers' reports validated the mission, direction, and activities implemented by ST ecosystem science programs. The panel also noted additional resources are needed to expand the scopes and geographic coverage of the programs. The reviewers recognized the devotion of ST staff and leadership, and they were impressed by the outstanding accomplishments despite very limited resources. This encouraging review will motivate ST staff and leadership to continue to pursue excellence in all aspects of ecosystem science programs.

Response to Recommendations and Other Observations

The review panel Chair provided a summary report of the program review, and the four other panelists provided detailed individual reports. Four major, overarching observations and associated recommendations were concluded from the report (1 - 4 below). In addition, the panel provided recommendations focused on the six individual programs/activities. In the following sections we summarize the substantive points identified by the panelists and provide ST's response and associated actions.

1. Goals and Objectives of ST Ecosystem Activities

Panelists identified the need for a better overall strategy for the collective marine ecosystem efforts within ST. They recommended the strategy should clearly define the overarching goals of the Marine Ecosystems Division and how the programs support them. This should include the boundaries of the programs, how they fit together, and the products of each. They felt that ST should be a national-level champion that enables progress for developing and applying the knowledge-base for the ecosystem approach.

1.1 ST appreciates these comments and understands the need for an improved strategy. ST will refine its strategy to better define its overarching goals, the roles of the current programs and activities, their products, and how the programs complement one another. ST will also work to improve the coordination and synergy among its programs. The strategy will also define a structure that positions the Marine Ecosystems Division to implement and lead a coherent and composite array of programs that supports advancing ecosystem science for NMFS as well as NOAA.

2. Communication

Panelists recommended an increased effort to communicate the status and accomplishments of the programs, including a greater web presence to communicate regional and national program results.

2.1 ST agrees that the communication of program activities and accomplishments is important. ST will review and update its websites, as appropriate, to ensure national and regional results in each program area are appropriately presented and program products are clearly described. ST websites will be reviewed annually at a minimum.

2.2 ST will continue to provide regular program status reports to the NMFS Science Board.

2.3 Additional communication actions are presented within the program/activity sections below.

3. Integration of Internal Proposal Requests

Panelists suggested the integration of internal requests for proposals for the ST programs that have them, which includes the ecosystem programs FATE and Habitat.

3.1 ST will explore various approaches to integrate the internal requests for proposals (RFPs), e.g. alignment of RFP calendars, options for some of the smaller RFPs and cross-program proposals. Then, with clearance through the NMFS Science Board, implement the preferred options.

4. Human Dimension Connections

Panelists acknowledged that social and economic programs will be reviewed in 2017, but commented on the need to strengthen and better integrate human dimension components into the ecosystem programs.

4.1 As noted by the panelists, the NOAA IEA program is actively working to advance a priority program goal to better develop capacity for and integrate human dimensions into NOAA IEA. The program has a human dimensions representative on the Steering Committee, and has established a cross-region and Line Office IEA working group focused on developing core capacity within IEA to incorporate human dimensions into the process. In addition, there are human dimension experts participating on IEA teams in virtually all IEA regions to develop this capacity. For example, within the program's California Current region, the IEA's Social Wellbeing in Marine Management (SWIMM) team has established methodology needed to apply and translate social science to better understand and improve human wellbeing related to ecosystem-based management. This work is relevant to and extensible to the other IEA regions. As the program moves forward, human dimensions will continue to be a top priority area for growth in all regions, with the ultimate goal that social sciences become a seamless component of the IEA process. This includes enhancing ongoing work and partnerships with OAR Sea Grant, NOS NCCOS Social Science Team, and NMFS Human Dimensions program to develop methodology for and integrate human dimensions information into ecosystem-based decision support.

4.2 ST's Marine Ecosystems and Climate program has identified human dimensions as a key area of need and is working to increase efforts in this area. For example, in 2016 the Program formed a partnership with ST's Economics and Social Analysis Division and NOAA Sea Grant to explore efforts to advance understanding of climate-related impacts on human dimensions of fisheries and fishing communities. The partners held an initial workshop on science for climate resilient fishing communities in May 2016. The group is considering regional workshops and possible pilot projects for FY 2017.

4.3 The Marine Ecosystems and Climate program is helping NMFS human dimensions scientists to use information on fish stock climate vulnerability in their assessment of fishing community vulnerability. We have also made understanding climate-related impacts on human dimensions of fisheries a priority research topic in our joint NMFS-OAR competitive research program on climate and fisheries (see 8.2 below).

4.4 As noted in response 3.1, ST will explore approaches for integrating internal RFPs and consider options for some of the smaller RFPs. This discussion will include integrating economics and sociocultural research with the broader ecosystem research being conducted across the Agency.

4.5 The Economics & Human Dimensions Science Program Review will explicitly review integrated ecosystem research undertaken by this Program, identifying gaps and needs as well as the use of this information in management.

4.6 In FY 2017, ST will establish a working group to address several gaps in the application and measurement of ecosystem service values. The working group will be a focal point for efforts to identify and explicate appropriate utilization of ecosystem service values and the proper measurement of these values for use in NMFS' research, management, and policy activities.

5. Integrated Ecosystem Assessments (IEAs)

5.1 While panelists noted that the IEA program has a strong vision of what it wants to be, it was observed that there is some lack of clarity about the IEA process in NMFS Science Centers, including if it is a process, a product, or a tool. Panelists suggested that a clear definition of what IEA is should be

developed. It was further recommended that ST better define its ecosystem program, goals, and objectives – including the role of IEA in relation to other programs.

5.1.1 Adequately communicating NOAA IEA – e.g. what it is, how it works, what the benefits are, and success stories – has been a challenge for the program. We recognize this and to address it the program will be hiring a communications specialist in early FY 2017. The panel recommendation to better define IEA, and its process, for multiple audiences (including as a process, a product, and a tool) will be one of the early priorities for the IEA communications specialist.

5.1.2 NOAA IEA will contribute to development of an improved ST strategy for ecosystem science (1.1 above). As part of this strategy we will clarify the role of the IEA program in achieving the overall strategy as well as in relation to ST's other ecosystem science programs.

5.1.3 In addition, one panelist recommended the IEA program needs to "see an IEA brought to conclusion . . . and show this is a product and not just a process." We agree. "Closing the loop" on the IEA is a key priority for the program. Most of the 3-year IEA regional work plans identify completing a full IEA cycle as a priority goal. Thus if resources are maintained to support these activities, we should have multiple examples of a complete IEA in the next 1-2 years.

5.2 The Chair's report recognizes that the NOAA IEA program "is performing above its weight in terms of resources". The panel highlighted that the IEA operates on funds from multiple sources, including some that are not secure, and somewhat limited to fisheries-based sources. They recommend that there needs to be a commitment by ST to an appropriate funding amount for the program. They also suggest more funding sources need to be tapped.

5.2.1 We agree with the panel that the IEA program would benefit from additional and stable funding sources. While ST has a limited dedicated IEA budget line, and IEAs have greatly benefited from multiple years of additional funds from NMFS, the potentially fluid nature of the availability of the additional funds has made out-year IEA planning and program stability difficult. The NMFS Science Board has discussed the need to more effectively support the ecosystem science portfolio, including the IEA program, and recently supported current level of resources for IEA through the next fiscal year to fund implementation of year 2 of the three-year plan. ST in partnership with the Science Board will work to make these funds permanent over the next 1-2 years.

5.2.2 NMFS, as the administrative home for the NOAA program, recognizes the need to enhance cross-Line Office commitment to the program at the leadership level. There are plans for NMFS Science leadership to enhance engagement with counterparts in OAR and NOS, and encourage contribution of resources to the program to enable expanded IEA support for NOAA-wide missions.

5.3 The panelists remarked that for IEAs to achieve their full potential they need to have broader engagement with fisheries as well as with other NOAA missions. They further recommended that the program highlight success stories and develop clear messaging to illustrate the benefits of IEA to keep the community advancing towards more integrated approaches to meet NOAA and NMFS missions.

5.3.1 The NOAA IEA program recognizes the essential need for engagement and communication with our management partners. In all IEA regions we are working extensively with Fishery Management Councils on the benefits of an ecosystem-based approach to their management needs and to tailor IEA products to be most relevant to those needs. Similarly, as defined in each region's 3-year work plan, we are actively engaging with a broader range of management partners to support their needs through IEA (e.g. protected resources, habitat/river diversions, Regional Planning Bodies, National Marine Sanctuaries). Success of these partnerships will result in examples that illustrate the benefits of an integrated ecosystem-approach and facilitate efforts to broaden community engagement.

5.3.2 As noted in response 5.1.1, the IEA program will be hiring a communications specialist in early FY 2017. This priority investment is aimed at improving communication of program successes (e.g. regional stories that contribute to overall national program message). By better articulating

and disseminating these successes we anticipate better demonstration of the benefits of a more integrated approach through IEA and in effectively meeting marine resource management objectives. As an early part of this effort we will be re-developing our national IEA program website, to enable communication of our regional IEA goals, objectives, and successes as part of the broader national initiative and program results. This is also relevant to recommendation 2.

6. Fisheries and the Environment (FATE)

6.1 The panel recommended the FATE program to better define the boundaries with other programs.

6.1.1 As part of the revision of the strategic vision for ecosystem science (1.1 above) we will consider these program boundaries and articulate the scope and roles of ecosystem programs, including FATE.

6.2 The panel considered a need to develop further collaborations with the academic community. Specifically, the panel commented on the lack of a compatible academic program like FATE to provide basic research results to complement the more applied results within FATE.

6.2.1 The advantage of a compatible academic program to FATE is clear when one looks back to when GLOBEC and CAMEO were active programs with the academic sector. More comprehensive research by larger and longer lasting research teams contributed to understanding of ecosystems related to fisheries. ST will work with partners like the National Science Foundation and other agencies to explore collaborative activities that are appropriate based on the current capability of each agency. At the most basic level, enhanced communication about research priorities, funded projects, unfunded projects, and accomplishments will have positive effects without the pressure of developing a joint program.

6.3 Documentation of how FATE research is incorporated into stock assessments and management decisions and (more generally) the nature of FATE accomplishments was an important point made by the panel.

6.3.1 ST agrees that a portion of research results from FATE should move into decision making. Further, the application of these research results into stock assessments is an important detail to track. A study of FATE from 2010 to the present is underway to determine who received research results, how they employed them in decision making, and whether they were effective.

7. Habitat Science

7.1 Some panelists felt habitat science activities were not as well integrated with the other ecosystem science programs and felt ST should consider relocating the habitat activities into the Marine Ecosystems Division.

7.1.1 ST will transition management of its habitat science activities to the Marine Ecosystems Division to better integrate with other ecosystem science programs.

7.2 Panelists provided comments and recommendations concerning the scope and roles of the Habitat Program. These primarily focused on the habitat internal RFP being comparatively small and potentially expanding the scope of the Habitat Program.

7.2.1 As noted in response 3.1, ST will explore approaches for integrating internal RFPs and consider options for some of the smaller RFPs.

7.2.2 Regarding expanding the scope of the Habitat Program – both inshore and offshore habitats have always been included within the scope of the program. ST will improve its communication and outreach to demonstrate this more effectively.

7.3 Panelists commented on the Habitat Assessment Improvement Plan (HAIP) being six years old and suggested it may be due for an update.

7.3.1 Although the HAIP is six years old, there is still much to be done to implement the recommendations and the fundamental needs identified are not out of date. However, circumstances in NMFS have continued to evolve, with a recent greater focus on climate change and ecosystem-based fisheries management. As ST refines its overall strategy for ecosystem efforts, it will include a component that updates the context for the HAIP and habitat program to better align with current priorities and trends. ST does not support a full-scale rewrite of the HAIP at this time.

8. Marine Ecosystems and Climate

8.1 Panelists recommended the inclusion of a strong social science component given the potential impacts of climate on human dimensions of fisheries and fishing communities. They also recommended the consideration of mitigation and adaptation of communities to climate, in addition to research on shifts in distribution and productivity of exploited species.

8.1.1 See response 4.2 above. Current funding for Marine Ecosystems and Climate activities limits the Program's ability to address these topics in much detail.

8.2 The panel recommended continued work with OAR and other Line Offices doing climate research to minimize duplicated efforts and maximize leveraging.

8.2.1 This has been a major focus of the Program over the last five years resulting in increased coordination, collaboration, and leveraging with OAR, including the establishment of joint research efforts. For example, in 2014 the Program launched a joint climate and fisheries research program with the OAR Climate Program Office (COCA Program) to increase understanding and response to climate impacts on fish stocks and fisheries through external competitive grants. Due to limited funding this effort has focused on the NE region to date. In FY 2017 the Program will launch a new joint external competitive research effort with the OAR Climate Program Office (MAPP Program) to support development of better climate/ocean forecasts for use in marine resource management.

8.3 The panel recommended the Marine Ecosystems and Climate program clarify its boundaries and role with the IEA and FATE Programs.

8.3.1 As part of the revision of the strategic vision for ecosystem science (1.1 above) we will consider these program boundaries and articulate the scope and roles of ecosystem programs, including Marine Ecosystems and Climate. The Marine Ecosystems and Climate, IEA and FATE programs work closely together to help meet the large and growing needs for information on climate impacts on marine resources and resource-dependent communities. All three programs have clear roles in helping meet the needs identified in the NOAA Fisheries Climate Science Strategy. The programs will continue to work closely together to clarify roles, increase coordination and foster collaboration.

8.4 The panel recommended ST identify a strategy and resources to implement the NMFS Climate Science Strategy – Regional Action Plans.

8.4.1 The Program has worked closely with NMFS leadership on strategies to implement the Regional Action Plans beginning in FY 2017. Each NMFS Science Center will lead efforts to implement the Regional Action Plan for its region including tracking and reporting of progress. Given the limited resources currently available for implementation of the Plans, efforts are underway to identify how existing programs within NMFS, and some parts of OAR, can assist in implementation.

9. Plankton Database – COPEPOD

9.1 The panel recognized COPEPOD as a well-respected global plankton database that should continue to develop. While well-known outside of NMFS, the panel noted that it was not very well known within the Science Centers, and suggested that more effort should be made to better introduce it. The potential for plankton to become more important in EBFM and IEAs was also recognized.

9.1.1 ST acknowledges that while COPEPOD has worked closely with individual plankton scientists in each region for many years, it has not been well introduced to the larger Science Center community. In the upcoming year, ST plans to present COPEPOD at national FATE and IEA meetings, giving it more exposure and contact within these communities.

9.1.2 ST will facilitate and support a national NMFS Zooplankton Workshop in FY18. This meeting will discuss past results, current applications, new technologies, and how zooplankton information can play a bigger role in IEA and EBFM analyses.

Through these interactions, COPEPOD will work towards stronger communications with the Science Centers and NMFS scientists and get more involved in regular EBFM and IEA activities to better meet their needs.

9.2 Some panelists expressed concern that COPEPOD must stay current with emerging technologies in plankton sampling (e.g., image-based systems, genomics) and data exchange (e.g., data standards, web-based services).

9.2.1 Some of the extended activities of COPEPOD were not discussed in its presentation. For example, COPEPOD plays a core database support roll within the International Council for the Exploration of the Sea (ICES) Working Group on Molecular and Morphological Taxonomy, a group which is focused on both genomic and image-based taxonomy and data. COPEPOD also participates in multiple ICES, Scientific Committee on Ocean Research, and IOC-UNESCO scientific working groups that discuss latest technologies and data needs. From the data management side, COPEPOD interacts with data and technology-level staff at the NOAA National Centers for Environmental Information, the world data center PANGAEA, the British Oceanographic Data Center, and the Biological and Chemical Oceanography Data Management Office. Through its ICES and International Oceanographic Data and Information Exchange interactions, COPEPOD has reviewed and contributed to many of the plankton-related data and metadata standards that are in use today.

10. Ecosystem Modeling Coordination

Panelists acknowledged this is a new activity and generally agreed this coordination function is needed and ST is an appropriate location for it. Recommendations were aimed towards ensuring the activity is well coordinated and utilized within the Division and across the Science Centers.

10.1 Some panelists highlighted the need to clarify priorities for this activity and to prevent redundancies with other programs in the Marine Ecosystem Divisions (e.g., FATE, IEA, and Climate).

10.1.1 As part of the revision of the strategic vision for ecosystem science (1.1 above) we will consider program boundaries and articulate the scope and roles of ecosystem programs and activities, including ecosystem modeling coordination.

10.1.2 The modeling coordinator will communicate regularly with other programs to prevent redundancies and to ensure ecosystem modeling needs for those programs are being met.

10.1.3 Priorities for ecosystem modeling are outlined in the EBFM Road Map. As this document is reviewed and finalized, priorities can be more clearly planned. Assessing trade-offs in management given scientific uncertainties, as mentioned in the review, will be a major priority.

10.2 A few panelists suggested a workshop to introduce the program and ensure stakeholders, i.e. Science Center modelers, are included in the program.

10.2.1 A National Ecosystem Modeling Workshop (NEMoW) is planned for FY 2017. During this workshop, the participants will have an opportunity to hear more about this coordination function and provide input.

10.3 Panelists pointed out the opportunity to learn from other programs within the Division and suggested that this activity have a standing steering committee similar to other programs in the Division.

10.3.1 A steering committee for the planned NEMoW is being convened. In addition to planning the workshop, the committee will discuss the need for a standing committee or alternatives to ensure communications between ST and the Science Centers, as well as across Science Centers.

Table 1. Summary of action items and schedules arising from the 2016 Ecosystem Science Office of Science & Technology Program Review.

Action Item	Schedule
1.1 ST will update its marine ecosystems strategy to better define its overarching goals, the roles of the programs and activities, and their products.	FY17: quarter 3
2.1 ST will update its ecosystem science program websites.	FY17: quarter 4; then ongoing
2.2 ST will provide regular program status reports to the NMFS Science Board.	ongoing
3.1 ST will explore approaches to integrate internal requests for proposals and implement preferred options cleared through the NMFS Science Board.	FY17: quarter 4
4.5 The Economics & Human Dimensions Science Program Review will review integrated ecosystem research, identifying gaps and needs and the use of this information in management.	FY17: quarter 4
4.6 ST will establish a working group to address gaps in the application and measurement of ecosystem service values.	FY17: quarter 3
5.1.1 ST will hire an IEA communications specialist and better define NOAA IEAs and communicate results	FY17: quarter 1; then ongoing
5.2.1/5.2.2 ST and NMFS will continue to push for secure funding for the IEA program and encourage contribution of resources from other NOAA Line Offices.	ongoing
5.3.1 The NOAA IEA program will continue engaging with the Fishery Management Councils and other management bodies to support their needs.	ongoing
5.3.2 The NOAA IEA program will redevelop its national program website.	FY17: quarter 4
6.3.1 ST will document who received FATE research results from projects from 2010 to the present, how the results were employed in decision making, and whether they were effective.	FY17: quarter 3
7.1.1 ST will transition management of its habitat science activities to the Marine Ecosystems Division.	FY17: quarter 3
7.2.2 ST will improve its habitat science communication and outreach activities.	ongoing
7.3.1 ST will update the context for the HAIP and habitat program to better align with current priorities.	FY18: quarter 3
8.2.1 ST will co-fund new projects with the OAR Climate Program Office MAPP and	FY17: quarter 3;

COCA programs.	quarter 4
8.4.1 ST and NMFS will continue to push for secure funding for the Marine Ecosystems and Climate program and encourage contribution of resources from other NOAA Line Offices.	ongoing
9.1.1 ST will present COPEPOD at national FATE and IEA meetings to help establish new connections with NMFS Science Centers.	FY17: quarter 3; quarter 4
9.1.2 ST will facilitate and support a national NMFS Zooplankton Workshop.	FY18: TBD
10.2.1/10.3.1 ST will lead a NMFS National Ecosystem Modeling Workshop.	FY17: quarter 3